Appendix B

Complete PDS Catalog Object Template Set

This appendix provides a complete set of the PDS catalog objects in alphabetical order. Each section includes a description, a list of sub-objects, guidelines to follow in filling them out, and a specific example of the object.

The templates are used to load the PDS Data Set Catalog. (DATA_SET_MAP_PROJECTION and SOFTWARE are exceptions. They are not used currently to load data into the catalog.)

Templates are also used as documentation on PDS archived data sets. PDS requires that either the full set of templates be present in the CATALOG subdirectory or the file VOLINFO.TXT be present in the DOCUMENT subdirectory of an archive volume. See the File Specification and Naming chapter of this document for pointer and file names used with catalog object templates.

Depending on the type of data you are submitting, you may not need to complete every template. Your PDS Central Node Data Engineer will supply you with blank catalog templates to be completed.

Definitions and examples are provided here for your convenience. Additional examples may be obtained by contacting your Data Engineer.

The examples reflect the format to ingest metadata into the PDS catalog. Text descriptions (e.g., DATA_SET_DESC, INSTRUMENT_DESC) should not exceed 80 characters inclusive of <CR><LF> line delimiters. Of note is the underlining convention for headings and subheadings in longer text fields. Main headings are double-underlined through the use of the equal-sign key (=) which corresponds to ASCII decimal 61. Subheadings are single-underlined through the use of the hyphen key (-) which corresponds to ASCII decimal 45. This underlining convention enhances legibility, and in the future will facilitate the creation of hypertext links.

Also, PDS has adopted a convention for indenting primary headings, secondary headings, and textual descriptions to facilitate readability and to make a better presentation on the web. Primary headings start at Column 3. Text under primary headings and secondary headings start at Column 5. Text under secondary headings start at Column 7.

Again for ease of readability, there should be 2 blank lines before the start of a primary or secondary heading. If a secondary heading immediately follows a primary heading, then only 1 blank should separate the secondary heading from the primary heading.

PDS has developed a Windows based program (FORMAT70) that will automatically format the description fields of any catalog template.

```
DATA_SET_DESC            = "

  Primary Heading - starts at Column 3
  ========================
    Text under headings start at Column 5
    more text ...
(blank line)
(blank line)
    Secondary Heading - starts at Column 5
    ---------------------------------------
      Text under subheadings start at Column 7
      more text
(blank line)
(blank line)
  Primary Heading - starts at Column 3
  ========================
(blank line)
    Secondary Heading - starts at Column 5
    ---------------------------------------
      Text under subheadings start at Column 7
      more text
```

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B.1 DATA SET

The DATA SET catalog object is used to submit information about a data set to the PDS. The catalog object includes a free-form textual description of the data set and sub-objects for identifying associated targets, hosts, and references. A separate REFERENCE object will need to be completed for any new references not already part of the PDS catalog.

(1) The DATA SET INFORMATION catalog object includes two free-form textual descriptions, DATA_SET_DESC and CONFIDENCE_LEVEL_NOTE.

NOTE: The following paragraph headings and subheadings are recommended as the minimum set of headings needed to describe a data set adequately. Additional headings and sub-headings may be added as desired. Should any of the more common headings not appear within a textual description, it will be considered not applicable to the data set.

Under DATA_SET_DESC =

Data Set Overview

A high level description of the characteristics and properties of a data set.

Parameters

Describe the primary parameters (measured or derived quantities) included in the data set, also units and sampling intervals.

Processing

Describe the overall processing used to produce the data set. Include a description of the input data (and source), processing methods or software, and primary parameters or assumptions used to produce the data set.

Data

Describe in detail each data type identified in the Data Set Overview, (e.g., Ancillary Data, Image Data, Table Data, etc.).

Ancillary Data

Describe ancillary information needed in interpreting the data set. These may or may not be provided along with the data set. Include sources or references for locating ancillary data.

Coordinate System

Describe the coordinate system or frame of reference to be used for proper interpretation of the data set.

Software

Describe software for use with the data set. This may include software supplied with the data set, or software or systems that may be accessed independently to assist in visualization or analysis of the data.

Media/Format

Describe the media on which the data set is available for distribution. Include format information that may limit the use of the data set on specific hardware platforms (e.g., binary/ascii, IBM EBCDIC format).

Under CONFIDENCE_LEVEL_NOTE =

Confidence Level Overview

A high level description of the level of confidence (e.g., reliability, accuracy, or certainty) of the data.

Review

Briefly describe any review process that took place prior to release of the data set to insure the accuracy and completeness of the data and associated documentation.

Data Coverage and Quality

Describe the overall data coverage and quality. This should include information about gaps in the data (both for times or regions). Include descriptions of how missing or poor data are flagged or filled, if applicable.

Limitations

Describe limitations on the use of the data set. For example, discuss other data required to properly interpret the data, or special processing systems expected to be used to further reduce the data set for analysis. If the data set is calibrated or otherwise corrected or derived, describe any known anomalies or uncertainties in the results.

(OTHER - Data Supplier provided):

Add any other important information in additional headings as desired (e.g., Data Compression, Time-Tagging, etc.)

(2) The DATA SET TARGET catalog object is completed for each target associated with the data set. If there is more than one target, this object is repeated.

(3) The DATA SET HOST catalog object is completed for each host/instrument pair associated with the data set. If there is more than one host/instrument pair, this object is repeated.

(4) The DATA SET REFERENCE INFORMATION catalog object is completed for each reference associated with the data set (e.g., articles, papers, memoranda, published data, etc.). If there is more than one reference, this object is repeated. A separate REFERENCE template is completed to provide the proper citation for each reference.

Important references including data set description, calibration procedures, processing software documentation, review results, etc. should be included. These can be both published and internal documents or informal memoranda.

Example:

```
/* Template: Data Set Template                                    Rev: 1993-09-24 */
/*                                                                                */
/* Note:   Complete one for each data set. Identify multiple targets associated with */
/*         the data set by repeating the 3 lines for the DATA_SET_TARGET object.     */
/*         Identify multiple hosts associated with the data set by repeating the 4 lines */
/*         for the DATA_SET_HOST object. Identify multiple references associated     */
/*         with the data set by repeating the 3 lines of the                        */
/*         DATA_SET_REFERENCE_INFORMATION object.                                   */

/* Hierarchy:   DATA_SET                                                            */
/*                DATA_SET_INFORMATION                                              */
/*                DATA_SET_TARGET                                                   */
/*                DATA_SET_HOST                                                     */
/*                DATA_SET_REFERENCE_INFORMATION                                    */

CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                          = PDS3
LABEL_REVISION_NOTE                     = "RSIMPSON, 1998-07-01"
RECORD_TYPE                             = STREAM

OBJECT = DATA_SET
DATA_SET_ID                             = "MGN-V-RDRS-5-GVDR-V1.0"

OBJECT                                  = DATA_SET_INFORMATION
DATA_SET_NAME                           = "MGN V RDRS DERIVED GLOBAL VECTOR
                                          DATA RECORD V1.0"
DATA_SET_COLLECTION_MEMBER_FLG          = "N"
DATA_OBJECT_TYPE                        = TABLE
START_TIME                              = 1990-08-01T00:00:00
STOP_TIME                               = 1993-12-31T23:59:59
DATA_SET_RELEASE_DATE                   = 1994-07-01
PRODUCER_FULL_NAME                      = "MICHAEL J. MAURER"
DETAILED_CATALOG_FLAG                   = "N"
DATA_SET_DESC                           = "

    Data Set Overview
    =================
      The Global Vector Data Record (GVDR) is a sorted collection of scattering and emission measurements from the
      Magellan Mission.The sorting is into a grid of equal area 'pixels' distributed regularly about the planet. For data acquired
      from the same pixel but in different observing geometries, there is a second level of sorting to accommodate the different
      geometrical conditions. The 'pixel' dimension is 18.225 km. The GVDR is presented in Sinusoidal Equal Area
      (equatorial), Mercator (equatorial), and Polar Stereographic (polar) projections.

      The GVDR is intended to be the most systematic and comprehensive representation of the electromagnetic properties of
      the Venus surface that can be derived from Magellan data at this resolution. It should be useful in characterizing and
      comparing distinguishable surface units.


    Parameters
    ==========
      The Magellan data set comprises three basic data types: echoes from the nadir-viewing altimeter (ALT), echoes from the
      oblique backscatter synthetic aperture radar (SAR) imaging system, and passive radio thermal emission measurements
      made using the SAR equipment. The objective in compiling the GVDR is to obtain an accurate estimate of the surface
      backscattering function (sometimes called the specific backscatter function or 'sigma-zero') for Venus from these three
```

data types and to show its variation with incidence (polar) angle, azimuthal angle, and surface location.

The ALT data set has been analyzed to yield profiles of surface elevation [FORD&PETTENGILL1992] and estimates of surface Fresnel reflectivity and estimates of meter-scale rms surface tilts by at least two independent methods [FORD&PETTENGILL1992;TYLER1992]. The 'inversion' approach of [TYLER1992] provides, in addition, an empirical estimate of the surface backscatter function at incidence angles from nadir to as much as 10 degrees from nadir in steps of 0.5 degrees.

Statistical analysis of SAR image pixels for surface regions about 20 km (across track) by 2 km (along track) provided estimates of the surface backscatter function over narrow angular ranges (1-4 degrees) between 15 and 50 degrees from normal incidence [TYLER1992]. By combining results from several orbital passes over the same region in different observing geometries, the backscatter response over the full oblique angular range (15-50) could be compiled. In fact, the number of independent observing geometries attempted with Magellan was limited, and some of these represented changes in azimuth rather than changes in incidence (or polar) angle. Nevertheless, data from many regions were collected in more than one SAR observing geometry. Histograms of pixel values and quadratic fits to the surface backscattering function over narrow ranges of incidence angle were computed by [TYLER1992].

Passive microwave emission by the surface of Venus was measured by the Magellan radar receiver between ALT and SAR bursts.These measurements have been converted to estimates of surface emissivity [PETTENGILLETAL1992]. With certain assumptions the emissivity derived from these data should be the complement of the Fresnel reflectivity derived from the ALT echo strengths.In cases where the two quantities do not add to unity, the assumptions about a simple dielectric (Fresnel) interface at the surface of Venus must be adjusted.

Processing

The processing carried out at the Massachusetts Institute of Technology (MIT) to obtain altimetry profiles and estimates of Fresnel reflectivity and rms surface tilts has been described elsewhere [FORD&PETTENGILL1992]. In brief it involves fitting pre-computed templates to measured echo profiles; the topographic profiles, Fresnel reflectivities, and rms surface tilts are chosen to minimize differences between the data and templates in a least-squares sense. The estimates of emissivity require calibration of the raw data values and correction for attenuation and emission by the Venus atmosphere [PETTENGILLETAL1992]. These data have been collected by orbit number on a set of compact discs [FORD1992] and into a set of global maps, also distributed on compact disc [FORD1993].

At Stanford ALT-EDR tapes were the input for calculation of near-nadir empirical backscattering functions. For oblique backscatter, C-BIDR tapes from the Magellan Project and F-BIDR files obtained via Internet from Washington University were the input products. Output was collected on an orbit-by-orbit basis into a product known as the Surface Characteristics Vector Data Record (SCVDR). The SCVDR has been delivered to the Magellan Project for orbits through 2599; processing of data beginning with orbit 2600 and continuing through the end-of-Mission is spending completion of the first version of the GVDR.

Data

The GVDR data set comprises several 'tables' of results based on analysis of each of the data types described above. These include:

(1) Image Data Table
(2) Radiometry Data Table
(3) MIT ALT Data Table
(4) Stanford ALT Data Table

(1) Image Data Table
This table contains results from analysis of SAR image strips.The results are parameterized by the azimuth angle, the incidence (polar) angle, and the polarization angle. Quantities include the number of image frame lets used to compute the scattering parameters; the median, the mode, and the one-standard-deviation limits of the pixel histogram; and the three coefficients and the reference angle of the quadratic approximation to sigma-zero as a function of incidence angle.

(2) Radiometry Data Table

This table contains results from MIT analysis of the radiometry data. The results are parameterized by the azimuth angle, the incidence angle, and the polarization angle. The results include the number of radiometry footprints used to compute the estimate of thermal emissivity, the emissivity, and its variance.

(3) MIT ALT Data Table
This table contains results derived from the MIT altimetry data analysis. The results include the number of ARCDR ADF footprints used in computing the estimates of scattering properties for the pixel and estimates (and variances) of radius, rms surface tilt, and Fresnel reflectivity from the ARCDR.

(4) Stanford ALT Data Table
This table contains results from the Stanford analysis of altimetry data. Results include the number of SCVDR footprints used in computing the estimates of surface properties for this pixel, the centroid of the Doppler spectrum, the derived scattering function and the angles over which it is valid, variance of the individual points in the derived scattering function, and results of fitting analytic functions to the derived scattering function.

Ancillary Data
Ancillary data for most processing at both MIT and Stanford was obtained from the data tapes and files received from the Magellan Project. These included trajectory and pointing information for the spacecraft, clock conversion tables, spacecraft engineering data, and SAR processing parameters. For calibration of the radar instrument itself, Magellan Project reports (including some received from Hughes Aircraft Co.[BARRY1987; CUEVAS1989; SE011]) were used. Documentation on handling of data at the Jet Propulsion Laboratory was also used [BRILL&MEISL1990; SCIEDR; SDPS101].

Coordinate System
The data are presented in gridded formats, tiled to ensure that closely spaced points on the surface occupy nearby storage locations on the data storage medium. Four separate projections are used: sinusoidal equal area and Mercator for points within 89 degrees of the equator, and polar stereographic for points near the north and south poles. The projections are described by [SNYDER1987]; IAU conventions described by [DAVIESETAL1989] and Magellan Project assumptions [LYONS1988] have been adopted.

Software
A special library and several example programs are provided in source code form for reading the GVDR data files. The general-purpose example program will serve the needs of the casual user by accessing a given GVDR quantity over a specified region of GVDR pixels. More advanced users may want to write their own programs that use the GVDR library as a toolkit. The library, written in ANSI C, provides concise access methods for reading every quantity stored in the GVDR. It conveniently handles allgeometric and tiling transformations and converts any compressed qualitites to a standard native format. The general purpose program mentioned above provides an example of how to use this library.

Media/Format
The GVDR will be delivered to the Magellan Project (or its successor) using compact disc write once (CD-WO) media. Formats will be based on standards for such products established by the Planetary Data System (PDS) [PDSSR1992]."

CONFIDENCE_LEVEL_NOTE = "

Confidence Level Overview
The GVDR is intended to be the most systematic and comprehensive representation of the electromagnetic properties of the Venus surface that can be derived from Magellan data at this resolution. Nevertheless, there are limitations to what can be done with the data.

Review
The GVDR will be reviewed internally by the Magellan Project prior to release to the planetary community. The GVDR will also be reviewed by PDS.

Data Coverage and Quality

Because the orbit of Magellan was elliptical during most of its mapping operations, parts of the orbital coverage have higher resolution and higher signal-to-noise than others.

Cycle 1 Mapping

During Mapping Cycle 1, periapsis was near 10 degrees N latitude at altitudes of approximately 300 km over the surface. The altitude near the poles, on the other hand, was on the order of 3000 km. For all data types this means lower confidence in the results obtained at the poles than near the equator.

Further, the spacecraft attitude was adjusted so that the SAR antenna was pointed at about 45 degrees from nadir near periapsis; this was reduced to near 15 degrees at the poles.The objective was to compensate somewhat for the changing elevation and to provide scattering at higher incidence angles when the echo signal was expected to be strongest. The ALT antenna, at a constant 25 degree offset from the SAR antenna, followed in tandem but at angles which were not optimized for obtaining the best altimetry echo.

During Mapping Cycle 1 almost half the orbits provided SAR images of the north pole; because of the orbit inclination, ALT data never extended beyond about 85N latitude in the north and 85S in the south. No SAR images of the south pole were acquired during Mapping Cycle 1 because the SAR antenna was always pointed to the left of the ground track; the Cycle 1SAR image strip near the south pole was at a latitude equator ward of 85S.

Cycle 2 Mapping

During much of Mapping Cycle 2, the spacecraft was flown ‘backwards’ so as to provide SAR images of the same terrain but with ‘opposite side’ illumination. This adjustment also meant that the SAR could image near the Venus south pole (but not near the north pole). The ALT data continued to be limited to latitudes equator ward of 85N and 85S.

Cycle 3 Mapping

During Mapping Cycle 3 the emphasis was on obtaining SAR data from the same side as in Cycle 1 but at different incidence angles (for radar stereo). In fact, most data were acquired at an incidence angle of about 25 degrees, which meant that the ALT antenna was usually aimed directly at nadir instead of drifting from side to side, as had been the case in Cycle 1.These Cycle 3 data, therefore, may be among the best from the altimeter. Dynamic range in SAR data was larger than in Cycle1 because the incidence angle was fixed rather than varying to compensate for the changing spacecraft height.

All Cycles

It is important to remember that, since the SAR and ALT antennas were aimed at different parts of the planet during each orbit, building up a collection of composite scattering data for any single surface region requires that results from several orbits be integrated. In the case of data from polar regions, where only the SAR was able to probe, there will be no ALT data. When scheduling or other factors interrupted the systematic collection of data, there may be ALT data for some regions but no comparable SAR or radiometry data (or viceversa).

Note that for all Cycles outages played an important role in determining coverage. For example, although a goal of Cycle 3 radar mapping was radar stereo, early orbits were used to collect data at nominal incidence angles that had been missed during Cycle 1 because of thermal problems with the spacecraft. A transmitter failure during Cycle 3 caused a loss of further data. It is not within the scope of this description to provide detailed information on data coverage.

Limitations

Both the template fitting approach and the inversion approach will have their limitations in estimating overall surface properties for a region on Venus. The template calculation assumes that scattering is well-behaved at all incidence angles from 0 to 90 degrees and that a template representing that behavior can be constructed. The Hagfors function [HAGFORS1964]used by MIT, however, fails to give a finite rms surface tilt if used over this range of angles, so approximations based on a change in the scattering mechanism must be applied[HAGFORS&EVANS1968]. The inversion method [TYLER1992] is susceptible to noise at the higher incidence angles and this will corrupt solutions if not handled properly. Users of this data set should be aware that radar echoes are statistically variable and that each result has an uncertainty.

A nominal nadir footprint can be assigned to altimetry results, but this footprint is biased near periapsis because the ALT antenna is rotated about 20 degrees from nadir (during Cycle 1).Over polar regions in Cycle 1, the ALT antenna is rotated about 10 degrees to the opposite side of nadir. A more important consideration in polar regions is that the area illuminated by the ALT antenna is approximately 100 times as large as near periapsis because of the higher spacecraft altitude. The region contributing to echoes in polar regions -- and therefore the region over which estimates of Fresnel reflectivity and rms surface tilts apply -- is much larger than at periapsis. ”

```
END_OBJECT                    = DATA_SET_INFORMATION

OBJECT                        = DATA_SET_TARGET
TARGET_NAME                   = VENUS
END_OBJECT                    = DATA_SET_TARGET

OBJECT                        = DATA_SET_HOST
INSTRUMENT_HOST_ID            = MGN
INSTRUMENT_ID                 = RDRS
END_OBJECT                    = DATA_SET_HOST

OBJECT                        = DATA_SET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “BARRY1987”
END_OBJECT                    = DATA_SET_REFERENCE_INFORMATION

OBJECT                        = DATA_SET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “BRILL&MEISL1990”
END_OBJECT                    = DATA_SET_REFERENCE_INFORMATION

OBJECT                        = DATA_SET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “CUEVAS1989”
END_OBJECT                    = DATA_SET_REFERENCE_INFORMATION

OBJECT                        = DATA_SET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “DAVIESETAL1989”
END_OBJECT                    = DATA_SET_REFERENCE_INFORMATION

OBJECT                        = DATA_SET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “FORD1992”
END_OBJECT                    = DATA_SET_REFERENCE_INFORMATION


OBJECT                        = DATA_SET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “FORD1993”
END_OBJECT                    = DATA_SET_REFERENCE_INFORMATION

OBJECT                        = DATA_SET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “FORD&PETTENGILL1992”
END_OBJECT                    = DATA_SET_REFERENCE_INFORMATION

OBJECT                        = DATA_SET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “HAGFORS1964”
END_OBJECT                    = DATA_SET_REFERENCE_INFORMATION

OBJECT                        = DATA_SET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “HAGFORS&EVANS1968”
END_OBJECT                    = DATA_SET_REFERENCE_INFORMATION

OBJECT                        = DATA_SET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “LYONS1988”
END_OBJECT                    = DATA_SET_REFERENCE_INFORMATION

OBJECT                        = DATA_SET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “PDSSR1992”
```

```
END_OBJECT                    = DATA_SET_REFERENCE_INFORMATION

OBJECT                        = DATA_SET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “PETTENGILLETAL1992”
END_OBJECT                    = DATA_SET_REFERENCE_INFORMATION

OBJECT                        = DATA_SET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “SCIEDR”
END_OBJECT                    = DATA_SET_REFERENCE_INFORMATION

OBJECT                        = DATA_SET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “SDPS101”
END_OBJECT                    = DATA_SET_REFERENCE_INFORMATION

OBJECT                        = DATA_SET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “SE011”
END_OBJECT                    = DATA_SET_REFERENCE_INFORMATION

OBJECT                        = DATA_SET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “SNYDER1987”
END_OBJECT                    = DATA_SET_REFERENCE_INFORMATION

OBJECT                        = DATA_SET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “TYLER1992”
END_OBJECT                    = DATA_SET_REFERENCE_INFORMATION

END_OBJECT                    = DATA_SET

END
```

B.2 DATA SET COLLECTION

The DATA SET COLLECTION catalog object is used to link several data sets as a collection to be used and distributed together.

(1) The DATA SET COLLECTION INFO catalog object provides a description and usage, as well as other information specific to the data set collection. This object includes a free-form textual description, DATA_SET_COLLECTION_DESC.

NOTE: The paragraph headings and subheadings are recommended as the minimum set of headings needed to describe a data set collection adequately. Additional headings and sub-headings may be added as desired. Should any of the more common headings not appear within a textual description, it will be considered not applicable to the data set collection.

Under DATA_SET_COLLECTION_INFO =

Data Set Collection Overview
A high-level description of the characteristics and properties of a data set collection.

Data Set Collection Usage Overview
A high-level description of the intended use of a data set collection.

(2) The DATA SET COLL ASSOC DATA SET catalog object is repeated for each data set associated with the collection. For example, if there are three distinct data sets which make up a collection, this object will be repeated three different times, one object per data set.

(3) The DATA SET COLL REF INFO catalog object associated a reference with the data set collection. It is repeated for each reference to be identified for the collection. A separate REFERENCE template is completed to provide the associated reference citation for each new reference submitted to PDS.

Example:

```
/* Template: Data Set Collection Template                      Rev: 1993-09-24 */

/* Note:  Complete one template for each data set collection. Identify         */
/*        individual data sets that are included in the collection by          */
/*        repeating the 3 lines for the DATA_SET_COLL_ASSOC_DATA_SETS          */
/*        object. Identify each data set collection reference by               */
/*        repeating the 3 lines for the DATA_SET_COLL_REF_INFO object.         */
/*        Also complete a separate REFERENCE template for each new             */
/*        reference submitted to PDS.                                          */

/* Hierarchy:  DATA_SET_COLLECTION                                             */
/*               DATA_SET_COLLECTION_INFO                                      */
/*               DATA_SET_COLL_ASSOC_DATA_SETS                                 */
/*               DATA_SET_COLLECTION_REF_INFO                                  */
```

```
OBJECT                              = DATA_SET_COLLECTION
DATA_SET_COLLECTION_ID              = “PREMGN-E/L/H/M/V-4/5-RAD/GRAV-V1.0”

OBJECT                              = DATA_SET_COLLECTION_INFO
DATA_SET_COLLECTION_NAME            = “PRE-MGN E/L/H/M/V 4/5 RADAR/GRAVITY DATA V1.0”
DATA_SETS                           = 15
START_TIME                          = 1968-11-09T00:00:00
STOP_TIME                           = 1988-07-27T00:00:00
DATA_SET_COLLECTION_RELEASE_DT      = 1990-06-15
PRODUCER_FULL_NAME                  = “RAYMOND E. ARVIDSON”
DATA_SET_COLLECTION_DESC            = “
```

Data Set Collection Overview

This entity is a collection of selected Earth-based radar data of Venus, the Moon, Mercury, and Mars, Pioneer Venus radar data, airborne radar images of Earth, and line of sight acceleration data derived from tracking the Pioneer Venus Orbiter and Viking Orbiter 2. Included are 12.6 centimeter wavelength Arecibo Venus radar images, 12.6 to 12.9cm Goldstone Venus radar images and altimetry data, together with altimetry, brightness temperature, Fresnel reflectivity and rms slopes derived from the Pioneer Venus Radar Mapper. For the Moon, Haystack 3.8 centimeter radar images and Arecibo 12.6 and70 centimeter radar images are included. Mars data include Goldstone altimetry data acquired between 1971 and 1982 and araster data set containing radar units that model Goldstone and Arecibo backscatter observations. Mercury data consist of Goldstone altimetry files. The terrestrial data were acquired over the Pisgah lava flows and the Kelso dune field in the Mojave Desert, California, and consist of multiple frequency, multiple incidence angle views of the same regions. Data set documentation is provided, with references that allow the reader to reconstruct processing histories. The entire data set collection and documentation are available on a CD-ROM entitled Pre-Magellan Radar and Gravity Data.”

```
DATA_SET_COLLECTION_USAGE_DESC =    “
```

Data Set Collection Usage Overview

The intent of the data set collection is to provide the planetary science community with radar and gravity data similar to the kinds of data that Magellan will begin collecting in the summer of 1990. The data set collection will be used for pre-Magellan analyses of Venus and for comparisons to actual Magellan data. The entire data set collection and documentation are available on a CD-ROM entitled Pre-Magellan Radar and Gravity Data. A list of the hardware and software that may be used to read this CD-ROM can be obtained from the PDS Geosciences Discipline Node.”

```
END_OBJECT                           = DATA_SET_COLLECTION_INFO

OBJECT                              = DATA_SET_COLL_ASSOC_DATA_SETS
DATA_SET_ID                         = “NDC8-E-ASAR-4-RADAR-V1.0”
END_OBJECT                          = DATA_SET_COLL_ASSOC_DATA_SETS

OBJECT                              = DATA_SET_COLL_ASSOC_DATA_SETS
DATA_SET_ID                         = “ARCB-L-RTLS-5-12.6CM-V1.0”
END_OBJECT                          = DATA_SET_COLL_ASSOC_DATA_SETS

OBJECT                              = DATA_SET_COLL_ASSOC_DATA_SETS
DATA_SET_ID                         = “ARCB-L-RTLS-4-70CM-V1.0”
END_OBJECT                          = DATA_SET_COLL_ASSOC_DATA_SETS

OBJECT                              = DATA_SET_COLL_ASSOC_DATA_SETS
DATA_SET_ID                         = “ARCB-V-RTLS-4-12.6CM-V1.0”
END_OBJECT                          = DATA_SET_COLL_ASSOC_DATA_SETS

OBJECT                              = DATA_SET_COLL_ASSOC_DATA_SETS
DATA_SET_ID                         = “ARCB-L-RTLS-3-70CM-V1.0”
END_OBJECT                          = DATA_SET_COLL_ASSOC_DATA_SETS

OBJECT                              = DATA_SET_COLL_ASSOC_DATA_SETS
DATA_SET_ID                         = “GSSR-M-RTLS-5-ALT-V1.0”
END_OBJECT                          = DATA_SET_COLL_ASSOC_DATA_SETS
```

```
OBJECT                    = DATA_SET_COLL_ASSOC_DATA_SETS
DATA_SET_ID               = “GSSR-H-RTLS-4-ALT-V1.0”
END_OBJECT                = DATA_SET_COLL_ASSOC_DATA_SETS

OBJECT                    = DATA_SET_COLL_ASSOC_DATA_SETS
DATA_SET_ID               = “GSSR-V-RTLS-5-12.6-9CM-V1.0”
END_OBJECT                = DATA_SET_COLL_ASSOC_DATA_SETS

OBJECT                    = DATA_SET_COLL_ASSOC_DATA_SETS
DATA_SET_ID               = “HSTK-L-RTLS-4-3.8CM-V1.0”
END_OBJECT                = DATA_SET_COLL_ASSOC_DATA_SETS

OBJECT                    = DATA_SET_COLL_ASSOC_DATA_SETS
DATA_SET_ID               = “ARCB/GSSR-M-RTLS-5-MODEL-V1.0”
END_OBJECT                = DATA_SET_COLL_ASSOC_DATA_SETS

OBJECT                    = DATA_SET_COLL_ASSOC_DATA_SETS
DATA_SET_ID               = “P12-V-RSS-4-LOS-GRAVITY-V1.0”
END_OBJECT                = DATA_SET_COLL_ASSOC_DATA_SETS

OBJECT                    = DATA_SET_COLL_ASSOC_DATA_SETS
DATA_SET_ID               = “P12-V-ORAD-4-ALT/RAD-V1.0”
END_OBJECT                = DATA_SET_COLL_ASSOC_DATA_SETS

OBJECT                    = DATA_SET_COLL_ASSOC_DATA_SETS
DATA_SET_ID               = “P12-V-ORAD-5-RADAR-IMAGE-V1.0”
END_OBJECT                = DATA_SET_COLL_ASSOC_DATA_SETS

OBJECT                    = DATA_SET_COLL_ASSOC_DATA_SETS
DATA_SET_ID               = “P12-V-ORAD-5-BACKSCATTER-V1.0”
END_OBJECT                = DATA_SET_COLL_ASSOC_DATA_SETS

OBJECT                    = DATA_SET_COLL_ASSOC_DATA_SETS
DATA_SET_ID               = “VO2-M-RSS-4-LOS-GRAVITY-V1.0”
END_OBJECT                = DATA_SET_COLL_ASSOC_DATA_SETS

OBJECT                    = DATA_SET_COLLECTION_REF_INFO
REFERENCE_KEY_ID          = ARVIDSONETAL1990A
END_OBJECT                = DATA_SET_COLLECTION_REF_INFO

END_OBJECT                = DATA_SET_COLLECTION
END
```

B.3 DATA SET MAP PROJECTION

The DATA SET MAP PROJECTION object is one of two distinct objects that define the map projection used in creating the digital images in a PDS data set. The other associated object that completes the definition is the IMAGE MAP PROJECTION, which is fully described in Appendix A of this document.

The map projection information resides in these two objects essentially to reduce data redundancy and at the same time allow the inclusion of elements needed to process the data at the image level. Static information that is applicable to the complete data set reside in the DATA_SET_MAP_PROJECTION object while dynamic information that is applicable to the individual images reside in the IMAGE_MAP_PROJECTION object.

(1) The DATA_SET_MAP_PROJECTION catalog object unambiguously defines map projection of an image data set.

Under MAP_PROJECTION_DESC =

Map Projection Overview

A description of the map projection of the data set, indicating mathematical expressions used for latitude/longitude or line/sample transformations, line and sample projection offsets, center longitudes, etc., as well as any assumptions made in processing. (These categories of description may be subheadings indicated by single-underlining.)

Under ROTATIONAL_ELEMENT_DESCRIPTION_DESC =

Rotational Element Overview

A description of the standard used for the definition of a planet’s pole orientation and prime meridian, right ascension and declination, spin angle, etc. (Please see the Planetary Science Data Dictionary for complete description.).

NOTE: The value in this field may also be a bibliographic citation to a published work containing the rotation element description. In this case there would be no need to have the ‘Overview’ heading. Please see the example provided below.

(2) The REFERENCE object provides citations of papers, articles, and other published and unpublished works pertinent to the data set map projection.

Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                  = PDS3
LABEL_REVISION_NOTE             = “RSIMPSON, 1998-07-01”
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 80

SPACECRAFT_NAME                 = MAGELLAN
TARGET_NAME                     = VENUS

OBJECT                          = DATA_SET_MAP_PROJECTION
DATA_SET_ID                     = "MGN-V-RDRS-5-DIM-V1.0"

OBJECT                          = DATA_SET_MAP_PROJECTION_INFO
MAP_PROJECTION_TYPE             = "SINUSOIDAL"
MAP_PROJECTION_DESC             = "
```

Map Projection Overview

The FMAP (Magellan Full Resolution Radar Mosaic) is presented in a Sinusoidal Equal-Area map projection. In this projection, parallels of latitude are straight lines, with constant distances between equal latitude intervals. Lines of constant longitude on either side of the projection meridian are curved since longitude intervals decrease with the cosine of latitude to account for their convergence toward the poles. This projection offers a number of advantages for storing and managing global digital data; in particular, it is computationally simple, and data are stored in a compact form.

The Sinusoidal Equal-Area projection is characterized by a projection longitude, which is the center meridian of the projection, and a scale, which is given in units of pixels/degree. The center latitude for all FMAP's is the equator. Each FMAP contains its own central meridian. The tiles that make up an FMAP all have the same central meridian as the FMAP.

Lat/Lon, Line/Sample Transformations

The transformation from latitude and longitude to line and sample is given by the following equations:

line = INT(LINE_PROJECTION_OFFSET - lat*MAP_RESOLUTION + 1.0)

sample = INT(SAMPLE_PROJECTION_OFFSET - (lon - CENTER_LONGITUDE)*MAP_RESOLUTION*cos(lat) + 1.0)

Note that integral values of line and sample correspond to center of a pixel. Lat and lon are the latitude and longitude of a given spot on the surface.

Line Projection Offset

LINE_PROJECTION_OFFSET is the line number minus one on which the map projection origin occurs. The map projection origin is the intersection of the equator and the projection longitude. The value of LINE_PROJECTION_OFFSET is positive for images starting north of the equator and is negative for images starting south of the equator.

Sample Projection Offset

SAMPLE_PROJECTION_OFFSET is the nearest sample number to the left of the projection longitude. The value of SAMPLE_PROJECTION_OFFSET is positive for images starting to the west of the projection longitude and is negative for images starting to the east of the projection longitude.

Center Longitude
CENTER_LONGITUDE is the value of the projection longitude,which is the longitude that passes through the center of the projection.

The values for FMAP products will be 1408, 235, and 35.

There are four PDS parameters that specify the latitude and longitude boundaries of an image. MAXIMUM_LATITUDE and MINIMUM_LATITUDE specify the latitude boundaries of the image,and EASTERNMOST_LONGITUDE and WESTERNMOST_LONGITUDE specify the longitudinal boundaries of the map.

Definitions of other mapping parameters can be found in the Planetary Science Data Dictionary."

```
ROTATIONAL_ELEMENT_DESC          = "See DAVIESETAL1989."

OBJECT                           = DS_MAP_PROJECTION_REF_INFO
REFERENCE_KEY_ID                 = "DAVIESETAL1989"
END_OBJECT                       = DS_MAP_PROJECTION_REF_INFO

OBJECT                           = DS_MAP_PROJECTION_REF_INFO
REFERENCE_KEY_ID                 = "BATSON1987"
END_OBJECT                       = DS_MAP_PROJECTION_REF_INFO

OBJECT                           = DS_MAP_PROJECTION_REF_INFO
REFERENCE_KEY_ID                 = "EDWARDS1987"
END_OBJECT                       = DS_MAP_PROJECTION_REF_INFO

OBJECT                           = DS_MAP_PROJECTION_REF_INFO
REFERENCE_KEY_ID                 = "SNYDER&JOHN1987"
END_OBJECT                       = DS_MAP_PROJECTION_REF_INFO

END_OBJECT                       = DATA_SET_MAP_PROJECTION_INFO
END_OBJECT                       = DATA_SET_MAP_PROJECTION

END
```

B.4 INSTRUMENT

The INSTRUMENT catalog object is used to submit information about an instrument to PDS. Instruments are typically associated with a particular spacecraft or earth based host, so the INSTRUMENT_HOST_ID keyword may identify either a valid SPACECRAFT_ID or EARTH_BASE_ID. The catalog object includes a textual description of the instrument and a sub-object for identifying reference information. A separate REFERENCE object will need to be completed for any new references not already part of the PDS catalog.

(1) The INSTRUMENT INFORMATION catalog object provides a description of the instrument. The following paragraph headings and suggested contents are strongly recommended as the minimal set of information necessary to adequately describe an instrument. Additional headings may be appropriate for specific instruments and these also may be added here. Should any of the recommended headings not appear within a textual description, they will be considered not applicable to the data set.

Instrument Overview
A high-level description of the characteristics and properties of an instrument.

Scientific Objectives
The scientific objectives of data obtained from this instrument.

Calibration
Methods/procedures/schedules of instrument calibration. Calibration stability, parameters, etc.

Operational Considerations
Special circumstances or events that affect the instrument's ability to acquire high quality data (which are reflected in the archive product). Examples might be spacecraft charging, thruster firings, contamination from other instruments, air quality, temperatures, etc.

Detectors
General description of detector(s). Type of detector used. Sensitivity and noise levels. Detector fields of view, geometric factors, etc. Instrument/detector mounting descriptions (offset angles, pointing positions, etc.)

Electronics
Description of the instrument electronics and internal data processing (A-D converter).

Filters
Description of instrument filters and filter calibrations (filter type, center wavelength, min/max wavelength) if applicable.

Optics

Description of instrument optics (focal lengths, transmittance, diameter, resolution, t_number, etc.) if applicable.

Location

Latitude and longitude location, for earth based instruments.

Operational Modes

Description of instrument configurations for data acquisitions. Description of "modes" (scan, gain, etc.) of data acquisition and of measured parameter(s) and/or data sampling rates or schemes used in each mode.

Subsystems

Logical subsystems of the instrument. Description of each subsystem, how it's used, which "modes" make use of which subsystem, etc.

Measured Parameters

Description of what the instrument directly measures (particle counts, magnetic field components, radiance, current/voltage ratios, etc.) Description and definition of these measurements (min/max, noise levels, units, time interval between measurements, etc.)

(OTHER - Data Supplier provided):

Any other important information in additional headings as desired (e.g. Data Reduction, Data Compression, Time-Tagging, Diagnostics, etc.)

(2) The INSTRUMENT REFERENCE INFO catalog object associates a reference with the instrument description. It is repeated for each reference identified for the instrument. A separate REFERENCE template is completed to provide the associated reference citation for each reference.

Include any important references such as instrument description and calibration documents. These can be both published and internal documents or informal memoranda.

Example:

```
/* Template: Instrument Template                  Rev: 1993-09-24                 */

/* Note:  Complete one template for each instrument. Identify each                */
/*        instrument reference by repeating the 3 lines for the                   */
/*        INSTRUMENT_REFERENCE_INFO object. Also complete a separate              */
/*        REFERENCE template for each new reference submitted to PDS.             */

/* Hierarchy:  INSTRUMENT                                                         */
/*               INSTRUMENT_INFORMATION                                           */
/*               INSTRUMENT_REFERENCE_INFO                                        */

CCSD3ZF0000100000001NJPL3IF0PDSX00000001
```

PDS_VERSION_ID	= PDS3
LABEL_REVISION_NOTE	= “RSIMPSON, 1998-07-01”
RECORD_TYPE	= STREAM

OBJECT = INSTRUMENT	
INSTRUMENT_HOST_ID	= “MGN”
INSTRUMENT_ID	= “RDRS”

OBJECT	= INSTRUMENT_INFORMATION
INSTRUMENT_NAME	= “RADAR SYSTEM”
INSTRUMENT_TYPE	= “RADAR”
INSTRUMENT_DESC	= “

Instrument Overview

The Magellan radar system included a 3.7 m diameter high gain antenna (HGA) for SAR and radiometry and a smaller fan-beam antenna (ALTA) for altimetry. The system operated at 12.6 cm wavelength. Common electronics were used in SAR, altimetry, and radiometry modes. The SAR operated in a burst mode; altimetry and radiometry observations were interleaved with the SAR bursts.

Radiometry data were obtained by spending a portion of the time between SAR bursts and after altimeter operation in a passive (receive-only) mode, with the HGA antenna capturing the microwave thermal emission from the planet. Noise power within the 10-MHz receiver bandwidth was detected and accumulated for50 ms. To reduce the sensitivity to receiver gain changes in this mode, the receiver was connected on alternate bursts first to a comparison dummy load at a known physical temperature and then to the HGA. The short-term temperature resolution was about 2 K; the long-term absolute accuracy after calibration was about 20 K.

The radar was manufactured by Hughes Aircraft Company and the 'build date' is taken to be 1989-01-01. The radar dimensions were 0.304 by 1.35 by 0.902 (height by length by width in meters) and the mass was 126.1 kg.

Instrument Id	: RDRS
Instrument Host Id	: MGN
Pi PDS User Id	: GPETTENGILL
Instrument Name	: RADAR SYSTEM
Instrument Type	: RADAR
Build Date	: 1989-01-01
Instrument Mass	: 126.100000
Instrument Length	: 1.350000
Instrument Width	: 0.902000
Instrument Height	: 0.304000
Instrument Manufacturer Name	: HUGHES AIRCRAFT

Platform Mounting Descriptions

The spacecraft +Z axis vector was in the nominal direction of the HGA boresight. The +X axis vector was parallel to the nominal rotation axis of the solar panels. The +Y axis vector formed a right-handed coordinate system and was in the nominal direction of the star scanner boresight. The spacecraft velocity vector was in approximately the -Y direction when the spacecraft was oriented for left-looking SAR operation. The nominal HGA polarization was linear in the y-direction.

Cone Offset Angle:	0.00
Cross Cone Offset Angle:	0.00
Twist Offset Angle:	0.00

The altimetry antenna boresight was in the x-z plane 25 degrees from the +Z direction and 65 degrees from the +X direction. The altimetry antenna was aimed approximately toward nadir during nominal radar operation. The altimetry antenna polarization was linear in the y-direction.

The medium gain antenna boresight was 70 degrees from the +Z direction and 20 degrees from the -Y direction. The low gain antenna was mounted on the back of the HGA feed; it's boresight was in the +Z direction and it had a hemispherical radiation pattern.

Principal Investigator

The Principal Investigator for the radar instrument was Gordon H. Pettengill.

For more information on the radar system see the papers by [JOHNSON1990] and [SAUNDERSETAL1990].

Scientific Objectives

See MISSION_OBJECTIVES_SUMMARY under MISSION.

Operational Considerations

The Magellan radar system was used to acquire radar back-scatter(SAR) images, altimetry, and radiometry when the spacecraft was close to the planet. Nominal operation extended from about 20minutes before periapsis until about 20 minutes after periapsis.In the SAR mode output from the radar receiver was sampled, blocks of samples were quantized using an adaptive procedure, and the results were stored on tape. In the altimetry mode samples were recorded directly, without quantization. Radiometry measurements were stored in the radar header records. During most of the remainder of each orbit, the HGA was pointed toward Earth and the contents of the tape recorder were transmitted to a station of the DSN at approximately 270 kilobits/second. SAR, altimetry, and radiometry data were then processed using ground software into images, altimetry profiles, estimates of backscatter coefficient, emissivity, and other quantities.

Calibration

The radar was calibrated before flight using an active electronic target simulator [CUEVAS1989].

Operational Modes

The Magellan radar system consisted of the following sections, each of which operated in the following modes:

Section	Mode
SAR	Synthetic Aperture Radar (SAR)
ALT	Altimetry
RAD	Radiometry

(1) SAR Characteristics

In the Synthetic Aperture Radar mode, the radar transmitted bursts of phase-modulated pulses through its high gain antenna. Echo signals were captured by the antenna, simple dat the receiver output, and stored on tape after being quantized to reduce data volume. Pulse repetition rate and incidence angle were chosen to meet a minimum signal-to-noise ratio requirement (8 dB) for image pixels after ground processing. Multiple looks were used in processing to reduce speckle noise. Incidence angles varied from about 13 degree sat the pole to about 44 degrees at periapsis during normal mapping operations (e.g., Cycle 1); but other 'look angle profiles' were used during the mission.

Peak transmit power	: 350 watts
Transmitted pulse length	: 26.5 microsecs
Pulse repetition frequency	: 4400-5800 per sec
Time bandwidth product	: 60
Inverse baud width	: 2.26 MHz
Data quantization (I and Q)	: 2 bits each
Recorded data rate	: 750 kilobits/sec
Polarization (nominal)	: linear horizontal
HGA half-power full beam width	: 2.2 deg (azimuth)
	: 2.5 deg (elev)
one-way gain (from SAR RF port)	: 35.7
dBi System temperature (viewing Venus)	: 1250 K
Surface resolution (range)	: 120-360 m
(along track)	: 120-150 m
Number of looks	: 4 or more
Swath width	: 25 km (approx)

Antenna look angle	: 13-47 deg
Incidence angle on surface	: 18-50 deg

Data Path Type	: RECORDED DATA
PLAYBACK Instrument Power Consumption	: UNK

(2) ALT Characteristics
After SAR bursts (typically several times a second) groups of altimeter pulses were transmitted from a dedicated fan beam altimeter antenna (ALTA) directed toward the spacecraft's nadir. Output from the radar receiver was sampled, and the samples were stored on tape for transmission to Earth. During nominal left-looking SAR operation the ALTA pointed approximately 20 deg to the left of the spacecraft ground track at periapsis and about 10 deg to the right of the ground track near the north and south pole.

Data quantization (I and Q)	: 4 bits each
Recorded data rate	: 35 kbs
Polarization	: linear
ALTA half-power full beam width	
(along track)	: 11 deg
(cross track)	: 31 deg
one-way gain referenced to ALT RF port	: 18.9
dBi ALTA offset from HGA	: 25 deg
Burst interval	: 0.5-1.0 sec
duration	: 1.0 millisec
Dynamic range	: 30 dB (or more)

Data Path Type	: RECORDED DATA
PLAYBACK Instrument Power Consumption	: UNK

(3) RAD Characteristics
Radiometry measurements were made by the radar receiver and HGA in a receive-only mode that was activated after the altimetry mode to record the level of microwave radio thermale mission from the planet. Noise power within the 10-MHz receiver bandwidth was detected and accumulated for 50 ms. To reduce the sensitivity to receiver gain changes in this mode, the receiver was connected on alternate bursts first to a comparison dummy load at a known physical temperature and then to the HGA. The short-term temperature resolution was about 2K; the long-term absolute accuracy after calibration was about20 K. At several times during the mission, radiometry measurements were carried out using known cosmic radio sources.

Receiver Bandwidth	: 10 MHz
Integration Time	: 50 millisecs
Polarization (nominal)	: linear horizontal
Data Quantization	: 12 bits
Data Rate	: 10-48 bits/sec
HGA half-power full beam width	: 2.2 deg
System temperature (viewing Venus)	: 1250 K
Antenna look angle	: 13-47 deg
Incidence angle on surface	: 18-50 deg
Surface resolution (along track)	: 15-120 km
(cross track)	: 20-125 km

Data Path Type	: RECORDED DATA PLAYBACK
Instrument Power Consumption	: UNK ”

```
END_OBJECT                    = INSTRUMENT_INFORMATION

OBJECT                        = INSTRUMENT_REFERENCE_INFO
REFERENCE_KEY_ID              = “CUEVAS1989”
END_OBJECT                    = INSTRUMENT_REFERENCE_INFO
```

```
OBJECT                          = INSTRUMENT_REFERENCE_INFO
REFERENCE_KEY_ID                = “JOHNSON1990”
END_OBJECT                      = INSTRUMENT_REFERENCE_INFO

OBJECT                          = INSTRUMENT_REFERENCE_INFO
REFERENCE_KEY_ID                = “SAUNDERSETAL1990”
END_OBJECT                      = INSTRUMENT_REFERENCE_INFO

END_OBJECT                      = INSTRUMENT

END
```

B.5 INSTRUMENT HOST

The INSTRUMENT HOST catalog object is used to describe a variety of instrument hosts, such as a spacecraft or an earth based observatory.

(1) The INSTRUMENT HOST INFORMATION catalog object provides a textual description that may be used to describe any important information about an instrument host. For spacecraft, this typically includes paragraphs on the various subsystems. Earthbased instrument host descriptions may focus on geographic and facility elements.

Instrument Host Overview
A high-level description of the characteristics and properties of the instrument host.

(2) The INSTRUMENT HOST REFERENCE INFO catalog object is completed for each reference associated with the host. If there is more than one reference, this object is repeated. A separate REFERENCE template is completed to provide the proper citation for each reference.

Example:

```
/* Template: Instrument Host Template                          Rev: 1993-09-24 */

/* Note:  Complete one template for each instrument host. Identify each          */
/*        instrument host reference by repeating the 3 lines for the            */
/*        INSTRUMENT_HOST_REFERENCE_INFO object. Also complete a separate       */
/*        REFERENCE template for each new reference submitted to PDS.           */

/* Hierarchy:  INSTRUMENT_HOST                                                  */
/*               INSTRUMENT_HOST_INFORMATION                                    */
/*               INSTRUMENT_HOST_REFERENCE_INFO                                 */

CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                  = PDS3
LABEL_REVISION_NOTE             = “RSIMPSON, 1998-07-01”
RECORD_TYPE                     = “STREAM”

OBJECT                          = INSTRUMENT_HOST
INSTRUMENT_HOST_ID              = “MGN”

OBJECT                          = INSTRUMENT_HOST_INFORMATION
INSTRUMENT_HOST_NAME            = “MAGELLAN”
INSTRUMENT_HOST_TYPE            = “SPACECRAFT”
INSTRUMENT_HOST_DESC            = “

    Instrument Host Overview
    ========================
      The Magellan spacecraft was built by the Martin Marietta Corporation. The spacecraft structure included four major
      sections: High-Gain Antenna (HGA), Forward Equipment Module (FEM), Spacecraft Bus (including the solar array), and
      the Orbit Insertion Stage. Spacecraft subsystems included those for thermal control, power, attitude control, propulsion,
      command data and data storage, and telecommunications.

      The Magellan telecommunications subsystem contained all the hardware necessary to maintain communications between
```

Earth and the spacecraft. The subsystem contained the radio frequency subsystem, the LGA, MGA, and HGA. The RFS performed the functions of carrier transponding, command detection and decoding, and telemetry modulation. The spacecraft was capable of simultaneous X-band and S-band uplink and downlink operations. The S-band operated at a transmitter power of 5 W, while the X-band operated at a power of 22 W. Uplink data rates were 31.25 and 62.5 bps (bits per second) with downlink data rates of 40 bps (emergency only), 1200 bps (real-time engineering rate), 115.2 kbps (kilobits per second) (radar down link backup), and 268.8 kbps (nominal).

For more information on the Magellan spacecraft see the papers by [SAUNDERSETAL1990] and [SAUNDERSETAL1992]. ”

```
END_OBJECT                        = INSTRUMENT_HOST_INFORMATION

OBJECT                            = INSTRUMENT_HOST_REFERENCE_INFO
REFERENCE_KEY_ID                  = “SAUNDERSETAL1990”
END_OBJECT                        = INSTRUMENT_HOST_REFERENCE_INFO

OBJECT                            = INSTRUMENT_HOST_REFERENCE_INFO
REFERENCE_KEY_ID                  = “SAUNDERSETAL1992”
END_OBJECT                        = INSTRUMENT_HOST_REFERENCE_INFO

END_OBJECT                        = INSTRUMENT_HOST
END
```

B.6 INVENTORY

The INVENTORY catalog object shall be completed once for each node that is responsible for orderable data sets from the PDS catalog. This object provides the inventory information necessary to facilitate the ordering of these data sets.

(1) The INVENTORY DATA SET INFO catalog object identifies a product through the product data set id. This object is repeated for each orderable and cataloged PDS data set.

(2) The INVENTORY NODE MEDIA INFO catalog object provides information about data set distribution medium. This object is repeated for each type of distribution medium.

Example:

```
/* Template: InventoryTemplate                                          Rev: 1990-03-20 */

/* Note:  The INVENTORY template shall be completed once for each node that is responsible    */
/*        for orderable data sets from the PDS catalog. The following hierarchy of templates provide */
/*        the necessary inventory information which will facilitate the ordering of these data sets. */

/* Hierarchy:  INVENTORY                                                */
/*               INVENTORY_DATA_SET_INFO                                */
/*               INVENTORY_NODE_MEDIA_INFO                              */

OBJECT                          = INVENTORY
NODE_ID                         = “IMAGING”

OBJECT                          = INVENTORY_DATA_SET_INFO
PRODUCT_DATA_SET_ID             = “VG2-N-ISS-2-EDR-V1.0”

OBJECT                          = INVENTORY_NODE_MEDIA_INFO
MEDIUM_TYPE                     = “MAG TAPE”
MEDIUM_DESC                     = “INDUSTRY STD 1/2IN;1600 OR 6250 BPI”
COPIES                          = 1
INVENTORY_SPECIAL_ORDER_NOTE    = “Not applicable.”
END_OBJECT                      = INVENTORY_NODE_MEDIA_INFO

OBJECT                          = INVENTORY_NODE_MEDIA_INFO
MEDIUM_TYPE                     = “CD-ROM”
MEDIUM_DESC                     = “Compact Disk”
COPIES                          = 1
INVENTORY_SPECIAL_ORDER_NOTE    = “Not applicable.”
END_OBJECT                      = INVENTORY_NODE_MEDIA_INFO

END_OBJECT                      = INVENTORY_DATA_SET_INFO
END_OBJECT                      = INVENTORY

OBJECT                          = INVENTORY
NODE_ID                         = “NSSDC”

OBJECT                          = INVENTORY_DATA_SET_INFO
PRODUCT_DATA_SET_ID             = “VG2-N-ISS-2-EDR-V1.0”
```

```
OBJECT = INVENTORY_NODE_MEDIA_INFO
MEDIUM_TYPE                          = “CD-ROM”
MEDIUM_DESC                          = “Compact Disk”
COPIES                               = 1
INVENTORY_SPECIAL_ORDER_NOTE         = “Not applicable.”
END_OBJECT                           = INVENTORY_NODE_MEDIA_INFO

END_OBJECT                           = INVENTORY_DATA_SET_INFO
END_OBJECT                           = INVENTORY
END
```

B.7 MISSION

The MISSION catalog object is used to submit information about a mission or campaign to PDS. Sub-objects are included for identifying associated instrument hosts, targets, and references. A separate REFERENCE object will need to be completed for any new references not already a part of the PDS catalog.

(1) The MISSION INFORMATION catalog object provides start and stop times and textual descriptions, MISSION_DESC and MISSION_OBJECTIVES_SUMMARY. Suggested contents include agency involvement, spacecraft/observatory utilized, mission scenario including phases, technology and scientific objectives.

Under MISSION_DESC =

Mission Overview
A high-level description of a mission.

Mission Phases
A description of each phase of a mission, starting with the pre-launch phase and continuing through end-of-mission. This includes start and stop times of each phase, intended operations, targets, and mission phase objectives.

Under MISSION_OBJECTIVES_SUMMARY =

Mission Objectives Overview
A high-level description of the objectives of the mission.

(2) The MISSION HOST catalog object is completed for each instrument host associated with the mission or campaign. If there is more than one instrument host involved in the mission, this object is repeated.

(3) The MISSION TARGET catalog object is completed for each target associated with an instrument host. If there is more than one target for a given host, this object is repeated.

(4) The MISSION REFERENCE INFORMATION catalog object is completed for each reference associated with the mission. If there is more than one reference, this object is repeated. A separate REFERENCE template is completed to provide the proper citation for each reference.

Example:

```
/* Template: Mission Template                        Rev: 1993-09-24                    */

/* Note:   Complete one template for each mission or campaign. Identify                 */
/*         multiple hosts associated with the mission by repeating the                  */
/*         lines beginning and ending with the MISSION_HOST values. For                 */
/*         each instrument_host identified, repeat the 3 lines for the                  */
/*         MISSION_TARGET object for each target associated with the host.              */
/*         Also complete a separate REFERENCE template for each new                     */
/*         reference submitted to PDS.                                                  */

/* Hierarchy: MISSION                                                                   */
/*         MISSION_INFORMATION                                                          */
/*         MISSION_HOST                                                                 */
/*         MISSION_TARGET                                                               */
/*         MISSION_REFERENCE_INFORMATION                                                */

CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                                       = PDS3
LABEL_REVISION_NOTE                                  = “RSIMPSON, 1998-07-01”
RECORD_TYPE                                          = STREAM

OBJECT                                               = MISSION
MISSION_NAME                                         = “MAGELLAN”

OBJECT                                               = MISSION_INFORMATION
MISSION_START_DATE                                   = 1989-05-04
MISSION_STOP_DATE                                    = UNK
MISSION_ALIAS_NAME                                   = “Venus Radar Mapper (VRM)”
MISSION_DESC= “
```

Mission Overview

The Magellan spacecraft was launched from the Kennedy Space Center on 4 May 1989. The spacecraft was deployed from the Shuttle cargo bay after the Shuttle achieved parking orbit.Magellan, using an inertial upper stage rocket, was then placed into a Type IV transfer orbit to Venus where it carried out radar mapping and gravity studies starting in August 1990. The Mission has been described in many papers including two special issues of the Journal of Geophysical Research [VRMPP1983;SAUNDERSETAL1990; JGRMGN1992]. The radar system is also described in [JOHNSON1990].

The aerobraking phase of the mission was designed to change the Magellan orbit from eccentric to nearly circular. This was accomplished by dropping periapsis to less than 150 km above the surface and using atmospheric drag to reduce the energy in the orbit. Aerobraking ended on 3 August 1993, and periapsis was boosted above the atmosphere leaving the spacecraft in an orbit that was 540 km above the surface at apoapsis and 197 km above the surface at periapsis. The orbit period was 94 minutes. The spacecraft remained on its medium-gain antenna in this orbit until Cycle 5 began officially on 16 August 1993.

During Cycles 5 and 6 the orbit was low and approximately circular. The emphasis was on collecting high-resolution gravity data. Two bistatic surface scattering experiments were conducted, one on 6 October (orbits 9331, 9335, and 9336) and the second on 9 November (orbits 9846-9848).

Mission Phases

Mission phases were defined for significant spacecraft activity periods. During orbital operations a ‘cycle’ was approximately the time required for Venus to rotate once under the spacecraft (about 243 days). But there were orbit adjustments and other activities that made some mapping cycles not strictly contiguous and slightly longer or shorter than the rotation period.

PRELAUNCH

The prelaunch phase extended from delivery of the spacecraft to Kennedy Space Center until the start of the launch countdown.

Spacecraft Id	: MGN
Target Name	: VENUS
Mission Phase Start Time	: 1988-09-01
Mission Phase Stop Time	: 1989-05-04
Spacecraft Operations Type	: ORBITER

LAUNCH

The launch phase extended from the start of launch countdown until completion of the injection into the Earth-Venus trajectory.

Spacecraft Id	: MGN
Target Name	: VENUS
Mission Phase Start Time	: 1989-05-04
Mission Phase Stop Time	: 1989-05-04
Spacecraft Operations Type	: ORBITER

CRUISE

The cruise phase extended from injection into the Earth-Venus trajectory until 10 days before Venus orbit insertion.

Spacecraft Id	: MGN
Target Name	: VENUS
Mission Phase Start Time	: 1989-05-04
Mission Phase Stop Time	: 1990-08-01
Spacecraft Operations Type	: ORBITER

ORBIT INSERTION

The Venus orbit insertion phase extended from 10 days before Venus orbit insertion until burnout of the solid rocket injection motor.

Spacecraft Id	: MGN
Target Name	: VENUS
Mission Phase Start Time	: 1990-08-01
Mission Phase Stop Time	: 1990-08-10
Spacecraft Operations Type	: ORBITER

ORBIT CHECKOUT

The orbit trim and checkout phase extended from burnout of the solid rocket injection motor until the beginning of radar mapping.

Spacecraft Id	: MGN
Target Name	: VENUS
Mission Phase Start Time	: 1990-08-10
Mission Phase Stop Time	: 1990-09-15
Spacecraft Operations Type	: ORBITER

MAPPING CYCLE 1

The first mapping cycle extended from completion of the orbit trim and checkout phase until completion of one cycle of radar mapping (approximately 243 days).

Spacecraft Id	: MGN
Target Name	: VENUS
Mission Phase Start Time	: 1990-09-15
Mission Phase Stop Time	: 1991-05-15
Spacecraft Operations Type	: ORBITER

MAPPING CYCLE 2

The second mapping cycle extended from completion of the first mapping cycle through an additional cycle of mapping.Acquisition of 'right-looking' SAR data was emphasized. Radio occultation measurements were carried out on orbits 3212-3214.A period of battery reconditioning followed completion of Cycle 2.

Spacecraft Id	: MGN
Target Name	: VENUS
Mission Phase Start Time	: 1991-05-16
Mission Phase Stop Time	: 1992-01-17
Spacecraft Operations Type	: ORBITER

MAPPING CYCLE 3

The third mapping cycle extended from completion of battery reconditioning through an additional cycle of mapping (approximately 243 days). Acquisition of 'stereo' SAR data was emphasized. The last orbit in the third cycle was orbit5747.

Spacecraft Id	: MGN
Target Name	: VENUS
Mission Phase Start Time	: 1992-01-24
Mission Phase Stop Time	: 1992-09-14
Spacecraft Operations Type	: ORBITER

MAPPING CYCLE 4

The fourth mapping cycle extended from completion of the third mapping cycle through an additional cycle of mapping. Acquisition of radio tracking data for gravity studies was emphasized. Radio occultation measurements were carried out on orbits 6369, 6370, 6471, and 6472. Because of poor observing geometry for gravity data collection at the beginning of the cycle, this cycle was extended 10 days beyond the nominal 243 days. Orbits included within the fourth cycle were 5748 through 7626. Periapsis was lowered on orbit 5752to improve sensitivity to gravity features in Cycle 4.

Spacecraft Id	: MGN
Target Name	: VENUS
Mission Phase Start Time	: 1992-09-14
Mission Phase Stop Time	: 1993-05-25
Spacecraft Operations Type	: ORBITER

AEROBRAKING

The aerobraking phase extended from completion of the fourth mapping cycle through achievement of a near-circular orbit.Circularization was achieved more quickly than expected; the first gravity data collection in the circular orbit was not scheduled until 11 days later. Orbits included within the aerobraking phase were 7627 through 8392.

Spacecraft Id	: MGN
Target Name	: VENUS
Mission Phase Start Time	: 1993-05-26
Mission Phase Stop Time	: 1993-08-05
Spacecraft Operations Type	: ORBITER

MAPPING CYCLE 5

The fifth mapping cycle extended from completion of the aerobraking phase through an additional cycle of mapping (approximately 243 days). Acquisition of radio tracking data for gravity studies was emphasized. The first orbit in the fifth cycle was orbit 8393.

Spacecraft Id	: MGN
Target Name	: VENUS
Mission Phase Start Time	: 1993-08-16
Mission Phase Stop Time	: 1994-04-15
Spacecraft Operations Type	: ORBITER

MAPPING CYCLE 6

The sixth mapping cycle extended from completion of the fifth mapping cycle through an additional cycle of mapping (approximately 243 days). Acquisition of radio tracking data for gravity studies was emphasized. The first orbit in the sixth cycle was orbit 12249.

Spacecraft Id	: MGN
Target Name	: VENUS
Mission Phase Start Time	: 1994-04-16
Mission Phase Stop Time	: TBD
Spacecraft Operations Type	: ORBITER”

MISSION_OBJECTIVES_SUMMARY = “

Mission Objectives Overview

Volcanic and Tectonic Processes

Magellan images of the Venus surface show widespread evidence for volcanic activity. A major goal of the Magellan mission was to provide a detailed global characterization of volcanic land forms on Venus and an understanding of the mechanics of volcanism in the Venus context. Of particular interest was the role of volcanism in transporting heat through the lithosphere.While this goal will largely be accomplished by a careful analysis of images of volcanic features and of the geological relationships of these features to tectonic and impact structures, an essential aspect of characterization will be an integration of image data with altimetry and other measurements of surface properties....

For more information on volcanic and tectonic investigations see papers by [HEADETAL1992] and [SOLOMONETAL1992], respectively.

Impact Processes

The final physical form of an impact crater has meaning only when the effects of the cratering event and any subsequent modification of the crater can be distinguished. To this end, a careful search of the SAR images can identify and characterize both relatively pristine and degraded impact craters, together with their ejecta deposits (in each size range) as well as distinguishing impact craters from those of volcanic origin.The topographic measures of depth-to-diameter ratio, ejecta thickness distribution as a function of distance from the crater, and the relief of central peaks contribute to this documentation.

.

For more information on investigations of impact processes see[SCHABERETAL1992].

Erosional, Depositional, and Chemical Processes

The nature of erosional and depositional processes on Venus is poorly known, primarily because the diagnostic landforms typically occur at a scale too small to have been resolved in Earth-based or Venera 15/16 radar images. Magellan images show wind eroded terrains, landforms produced by deposition (dunefields), possible landslides and other down slope movements, as well as aeolian features such as radar bright or dark streaks 'downwind' from prominent topographic anomalies. One measure of weathering, erosion, and deposition is provided by the extent to which soil covers the surface (for Venus, the term soil is used for porous material, as implied by its relatively low value of bulk dielectric constant). The existence of such material, and its dependence on elevation and geologic setting, provide important insights into the interactions that have taken place between the atmosphere and the lithosphere.

```
                .
                For more information on erosional, depositional, and chemical processes see papers by [ARVIDSONETAL1992],
                [GREELEYETAL1992],and [GREELEYETAL1994].


              Isostatic and Convective Processes
                Topography and gravity are intimately and inextricably related, and must be jointly examined when undertaking
                geophysical investigations of the interior of a planet, where isostatic and convective processes dominate.
                Topography provides a surface boundary condition for modeling the interior density of Venus.

                For more information on topography and gravity see papers by[FORD&PETTENGILL1992],
                [KONOPLIVETAL1993], and[MCNAMEEETAL1993]. ”

END_OBJECT                              = MISSION_INFORMATION

OBJECT                                  = MISSION_HOST
INSTRUMENT_HOST_ID                      = “MGN”

OBJECT                                  = MISSION_TARGET
TARGET_NAME                             = “VENUS”
END_OBJECT                              = MISSION_TARGET
END_OBJECT                              = MISSION_HOST

OBJECT                                  = MISSION_REFERENCE_INFORMATION
REFERENCE_KEY_ID                        = “ARVIDSON1991”
END_OBJECT                              = MISSION_REFERENCE_INFORMATION

OBJECT                                  = MISSION_REFERENCE_INFORMATION
REFERENCE_KEY_ID                        = “ARVIDSONETAL1992”
END_OBJECT                              = MISSION_REFERENCE_INFORMATION

OBJECT                                  = MISSION_REFERENCE_INFORMATION
REFERENCE_KEY_ID                        = “CAMPBELLETAL1992”
END_OBJECT                              = MISSION_REFERENCE_INFORMATION
          .
          .
          .
OBJECT                                  = MISSION_REFERENCE_INFORMATION
REFERENCE_KEY_ID                        = “TYLER1992”
END_OBJECT                              = MISSION_REFERENCE_INFORMATION

OBJECT                                  = MISSION_REFERENCE_INFORMATION
REFERENCE_KEY_ID                        = “VRMPP1983”
END_OBJECT                              = MISSION_REFERENCE_INFORMATION

END_OBJECT                              = MISSION
END
```

B.8 PERSONNEL

The PERSONNEL catalog object is used to provide new or updated information for personnel associated with PDS in some capacity. This includes data suppliers and producers for data sets or volumes archived with PDS, as well as PDS node personnel and contacts within other agencies and institutions.

(1) The PERSONNEL INFORMATION catalog object provides name, address, telephone, and related information.

(2) The PERSONNEL ELECTRONIC MAIL catalog object provides electronic mail information for personnel. This object may be repeated if more than one electronic mail address is applicable.

Example

```
/* Template: Personnel Template Rev: 1993-09-24 */

/* Note:   Complete one for each new PDS user, data supplier, or data        */
/*         producer. If more than one electronic mail address is available   */
/*         repeat the lines for the PERSONNEL_ELECTRONIC_MAIL object.        */

/* Hierarchy:   PERSONNEL                                                    */
/*                PERSONNEL_INFORMATION                                      */
/*                PERSONNEL_ELECTRONIC_MAIL                                  */

OBJECT                          = PERSONNEL
RECORD_TYPE                     = STREAM

PDS_USER_ID                     = PFORD

OBJECT                          = PERSONNEL_INFORMATION
FULL_NAME                       = “PETER G. FORD”
LAST_NAME                       = FORD
TELEPHONE_NUMBER                = “6172536485”
ALTERNATE_TELEPHONE_NUMBER      = “6172534287”
FAX_NUMBER                      = “6172530861”
INSTITUTION_NAME                = “MASSACHUSETTS INSTITUTE OF TECHNOLOGY”
NODE_ID                         = “GEOSCIENCE”
PDS_AFFILIATION                 = “NODE OPERATIONS MANAGER”
PDS_ADDRESS_BOOK_FLAG           = Y
REGISTRATION_DATE               = 1990-02-06
ADDRESS_TEXT                    = “Massachusetts Institute of Technology \n
                                  Center for Space Research Building 37-601Cambridge, MA 02139"
END_OBJECT                      = PERSONNEL_INFORMATION

OBJECT                          = PERSONNEL_ELECTRONIC_MAIL
ELECTRONIC_MAIL_ID              = “PGF@SPACE.MIT.EDU”
ELECTRONIC_MAIL_TYPE            = “INTERNET”
PREFERENCE_ID                   = 1
END_OBJECT                      = PERSONNEL_ELECTRONIC_MAIL

OBJECT                          = PERSONNEL_ELECTRONIC_MAIL
ELECTRONIC_MAIL_ID              = “PFORD”
```

```
ELECTRONIC_MAIL_TYPE                    = "NASAMAIL"
PREFERENCE_ID                           = 2
END_OBJECT                              = PERSONNEL_ELECTRONIC_MAIL

OBJECT                                  = PERSONNEL_ELECTRONIC_MAIL
ELECTRONIC_MAIL_ID                      = "JPLPDS::PFORD"
ELECTRONIC_MAIL_TYPE                    = "NSI/DECNET"
PREFERENCE_ID                           = 3
END_OBJECT                              = PERSONNEL_ELECTRONIC_MAIL

END_OBJECT                              = PERSONNEL
END
```

B.9 REFERENCE

The REFERENCE catalog object is completed for each reference associated with a mission, instrument host, instrument, data set, or data set collection catalog object. Submit any important references, including both published and unpublished internal documents or informal memoranda. This also may include references to published data, such as PDS archive volumes. A copy of an unpublished reference should be forwarded to the PDS node responsible for your data set archive, whenever possible.

(1) The REFERENCE catalog object provides a reference citation and a unique identifier for every reference associated with the PDS data archive.

Example:

```
/* Template: Reference Template                  Rev: 1993-09-24                    */

/* Note:   This template shall be completed for each reference associated with a mission,   */
/*         instrument host, instrument, data set, or data set collection template.          */

OBJECT                              = REFERENCE
REFERENCE_KEY_ID                    = “GURNETTETAL1991”
REFERENCE_DESC                      = “Garnet, D.A., W.S. Kurth, A. Roux, R. Gendrin, C. F. Kennel, S. J.
Bolton, Lightning and Plasma Wave Observations from the Galileo Flyby of Venus, Science, 253, 1522, 1991."
END_OBJECT                          = REFERENCE

OBJECT                              = REFERENCE
REFERENCE_KEY_ID                    = ARVIDSONETAL1990A
REFERENCE_DESC                      = “Arvidson, R.E., E.A. Guinness, S.
Slavney, D. Acevedo, J. Hyon, and M. Martin, Pre-Magellan radar and gravity data, Jet Propulsion Laboratory, CDROM
(USA_NASA_JPL_MG_1001).”
END_OBJECT                          = REFERENCE
END
```

B.10 SOFTWARE

The SOFTWARE catalog object is completed for each software program registered in the PDS Software Inventory. This Inventory includes software available within the Planetary Science community, including software on PDS archive volumes. Of interest are any applications, tools, or libraries that have proven useful for the display, analysis, formatting, transformation, or preparation of either science data or meta-data for the PDS archives.

(1) The SOFTWARE catalog object provides general information about the software tool including a description, availability information, and dependencies.

Example:

```
/* Template: Software Template                                Rev: 1998-12-01     */

/* Note:   This template should be completed to register software in the          */
/*         PDS Software Inventory.                                                */


OBJECT                              = SOFTWARE
   SOFTWARE_ID                      = NASAVIEW
   SOFTWARE_VERSION_ID              = "V1R2B"

OBJECT                              = SOFTWARE_INFORMATION
   SOFTWARE_NAME                    = "NASAVIEW - PDS DATA PRODUCT ACCESS TOOL
                                        V1.2B"
   DATA_FORMAT                      = PDS
   SOFTWARE_LICENSE_TYPE            = PUBLIC_DOMAIN
   TECHNICAL_SUPPORT_TYPE           = FULL
   REQUIRED_STORAGE_BYTES           = "1.8MB"
   PDS_USER_ID                      = SHUGHES
   NODE_ID                          = CN
   SOFTWARE_DESC                    = "

   Software Overview
   =============
     NasaView Version 1.2b is a PDS Image display program developed for the following platforms:
         (a) PC / Win32
         (b) Unix / Sun OS

     NasaView is capable of accessing and displaying all images, tables, cubes, and histograms in the PDS archive.
     This release has been tested using Galileo, Magellan, Viking, MDIM, Voyager, IHW LSPN, and Clementine
     uncompressed images.

     NasaView is planned as a PDS data product object display utility that will run on SUN, MAC, and PC platforms
     in a GUI environment.

     This application was built using the Label Library Light (L3), Object Access Library (OAL), and the XVT
     Development Solution for C package. Label Library Light parses PDS ODL labels and creates an in-memory
     representation of the label information. The Object Access Library uses the parse-tree and accesses the actual
     PDS object. The XVT Development Solution supplies the cross platform GUI and an Object-oriented
     environment. XVT allows the definition of visual objects such as Windows and Menus and associates events
     and code with them.

   Available Support Material
   ===================
```

```
      BINARIES


    Programming Language
    ================
      SUN_C


    Platforms Supported
    ==============
      PC / Microsoft Win95, Win98, NT4.0


    Support Software Required / Used
    ========================
      X_WINDOWS

END_OBJECT                          = SOFTWARE_INFORMATION

OBJECT                              = SOFTWARE_ONLINE
  ON_LINE_IDENTIFICATION            = “http://pds.jpl.nasa.gov/license.html”
  ON_LINE_NAME                      = “NASAVIEW REVISION 2 BETA”
  NODE_ID                           = CN
  PROTOCOL_TYPE                     = URL
  PLATFORM                          = PC/WIN32
END_OBJECT                          = SOFTWARE_ONLINE

OBJECT                              = SOFTWARE_PURPOSE
  SOFTWARE_PURPOSE                  = DISPLAY
END_OBJECT                          = SOFTWARE_PURPOSE

END_OBJECT                          = SOFTWARE
END
```

B.11 TARGET

The TARGET catalog object forms part of a standard set for the submission of a target to the PDS. The TARGET object contains the following sub-objects: TARGET_INFORMATION and TARGET_REFERENCE_INFORMATION

(1) The TARGET INFORMATION catalog object provides target physical and dynamic parameters.

(2) The TARGET REFERENCE INFORMATION catalog object is completed for each reference associated with the target. If there is more than one reference, this object is repeated. A separate REFERENCE template is completed to provide the proper citation for each reference.

Example

```
/* Template: Target Template              Rev: 1995-01-01          */

/* Note:  The following template is used for the                   */
/*        submission of a target to the PDS                        */

OBJECT                                    = TARGET
TARGET_NAME                               = JUPITER

OBJECT                                    = TARGET_INFORMATION
TARGET_TYPE                               = PLANET
PRIMARY_BODY_NAME                         = SUN
ORBIT_DIRECTION                           = PROGRADE
ROTATION_DIRECTION                        = PROGRADE
TARGET_DESC                               = "

  A_AXIS_RADIUS : 71492.000000
  B_AXIS_RADIUS : 71492.000000
  BOND_ALBEDO  : UNK
  C_AXIS_RADIUS : 66854.000000
  FLATTENING : 0.006500
  MAGNETIC_MOMENT : 155000000000000000000.000000
  MASS : 1898799999999999953652202602496.000000
  MASS_DENSITY : 1.330000
  MINIMUM_SURFACE_TEMPERATURE : UNK
  MAXIMUM_SURFACE_TEMPERATURE : UNK
  MEAN_SURFACE_TEMPERATURE : UNK
  EQUATORIAL_RADIUS : 71492.000000
  MEAN_RADIUS : 69911.000000
  SURFACE_GRAVITY : 25.900000
  REVOLUTION_PERIOD : 4333.000000
  POLE_RIGHT_ASCENSION : 268.000000
  POLE_DECLINATION : 64.500000
  SIDEREAL_ROTATION_PERIOD : 0.410000
  MEAN_SOLAR_DAY : 0.410000
  OBLIQUITY : 3.100000
  ORBITAL_ECCENTRICITY : 0.048000
  ORBITAL_INCLINATION : 1.300000
  ORBITAL_SEMIMAJOR_AXIS : 778376719.000000
  ASCENDING_NODE_LONGITUDE : 100.500000
```

```
    PERIAPSIS_ARGUMENT_ANGLE : 275.200000”

END_OBJECT                    = TARGET_INFORMATION

OBJECT                        = TARGET_REFERENCE_INFORMATION
REFERENCE_KEY_ID              = “XYZ95”
END_OBJECT                    = TARGET_REFERENCE_INFORMATION

END_OBJECT                    = TARGET
END
```